NON-PUBLIC?: N
ACCESSION #: 9209010062
LICENSEE EVENT REPORT (LER)

FACILITY NAME: McGuire Nuclear Station PAGE: 1 OF 10

DOCKET NUMBER: 05000369

TITLE: Unit 1 Experienced A Reactor Trip/Turbine Trip As A Result Of A Defective Procedure.
EVENT DATE: 07/26/92 LER #: 92-08-0 REPORT DATE: 08/25/92

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 99.5%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Terry L. Pedersen, Manager, TELEPHONE: (704) 875-4487
McGuire Safety Review Group

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On July 26, 1992, at 0852:01, while operating in mode 1 (Power operation) at 99.5 percent power, Unit 1 experienced a Reactor Trip/Turbine Trip on Overtemperature Delta Temperature (OTDT). The initiating event was the loss of Main Feedwater Pump Turbine (FWPT) 1B condenser vacuum. The loss of vacuum caused FWPT 1B to trip, resulting in a Load Rejection (Turbine runback). Due to a problem with the mixing amplifier card which processes the Reactor Coolant average temperature (T-ave) signal to the condenser steam dump valves, T-ave exceeded the OTDT setpoint in two of four channels, causing the Reactor trip. No load conditions were achieved in approximately two hours. This event has been assigned a root cause of Defective Procedure, due to a technical deficiency. The investigation revealed that the condenser steam dump valves operated properly within the condenser steam dump Load Rejection Controller, but not at the correct time due to improper calibration of the mixing

amplifier card. Procedure changes have been made to procedure IP/0/B/3001/03, Steam Dump Control System Calibration, to prevent recurrence of this problem.

END OF ABSTRACT

EVALUATION

Background

The Steam Dump Control System (IDE) EIIS:JI! provides an artificial steam load to enable the Nuclear Steam Supply System (NSSS) to follow turbine EIIS:TRB! load reductions without a Reactor EIIS:RCT! trip. It also prevents lifting of the Main Steam (SM) Code Safety and Power Operated Relief Valves (PORVs) EIIS:RV! on a Reactor/Turbine trip. The IDE consists of 4 control banks. Control banks 1 and 2 contain 9 pneumatically operated condenser steam dump valves EIIS:V!. These valves can handle 40 percent of design steam flow. Control banks 3 and 4 contain 8 pneumatically operated atmospheric valves which can handle 45 percent of design steam flow. The IDE control circuitry is found primarily in the Westinghouse 7300 Process Instrumentation and Control cabinets EIIS:CAB!, located in the Control Room EIIS:NA!.

The Overtemperature Delta Temperature (OTDT) trip is one of twenty Reactor trip inputs associated with the Reactor Protection System (IPE) EIIS:JC!. It protects the core against Departure from Nucleate Boiling (DNB) and causes the Reactor to trip when 2 out of 4 channels EIIS:CHA! exceed the setpoint. The OTDT trip setpoint is variable depending on the average Reactor Coolant temperature (T-ave), Pressurizer EIIS:PZR! pressure, and axial flux difference (AFD). The setpoint provides protection against DNB over a range of temperatures and pressures. The OTDT trip setpoint is continuously calculated by solving an equation given in Technical Specification (TS) Table 2.2-1, Reactor Trip System Instrumentation Trip Setpoints.

Description of Event

On July 24, 1992, at approximately 1711, Operations (OPS) personnel placed Main Feedwater Pump EIIS:P! Turbine (FWPT) 1B in the lead. Normally, FWPT 1A is in the lead during Mode 1 (Power Operation). However, FWPT 1A was experiencing high bearing vibration and it was felt that taking the pump out of the lead would help with the vibration problem. swapping the lead to FWPT 1B did not, however, reduce the vibration on FWPT 1A. OPS personnel decided to swap the lead back to

FWPT 1A on the following monday, July 27, 1992.

When FWPT 1B was placed in the lead on July 24, 1992, OPS Control Room personnel received an alarm EIIS:ALM! because of a slight loss of condenser EIIS:COND! vacuum associated with the pump. This was not unusual, though, because of the increased heat load imposed on FWPT 1B condenser, as a result of placing it in the lead. Over the next 2 days condenser vacuum on FWPT 1B decreased slightly, prompting OPS personnel to start looking for possible sources of air in-leakage. As part of the search, OPS personnel checked for water solid conditions in the Condenser Circulating Water (RC) piping, for clogs caused by Amertap condenser tube

cleaning balls, and checked the RC outlet temperatures on the FWPT cond
nsers. The results of this search revealed water solid conditions in the RC piping, no clogs caused by the Amertap balls; however, an increase in temperature was noted at the RC outlet, taken with a contact pyrometer, for FWPT 1B condenser (approximately 102 degrees Fahrenheit) as opposed to the RC outlet temperature on FWPT 1A (approximately 93 degrees Fahrenheit).

At 0850:53, on July 26, 1992, OPS Control Room Personnel received a "Hi CF Pump Turbine Condenser B Vacuum" alarm. FWPT 1B condenser vacuum was at -23.94 inches of mercury at that time. At the same time the "Trend Groups Variable Limit Exceeded" alarm was also received. The "Hi CF Pump Turbine Condenser B Vacuum" alarm was received again, at 0851:18. FWPT 1B condenser vacuum had decreased to -22.67 inches of mercury. At 0851:33, the vacuum had decreased to -21.27 inches of mercury. FWPT 1B tripped at 0851:35.201 and at 0851:35.331 the "Condensate System EIIS:KA! In Full Load Rejection Mode" alarm was received in the Control Room. OPS Control Room personnel began implementing procedure AP/1/A/5500/03, Load Rejection Case II. At 0851:57, the condenser steam dumps valves in control bank 1 started to modulate open. The control bank valves did not open fully. At this time, Pressurizer PORV 1NC-34 began lifting to relieve the increased primary side pressure. The "Hi NC Loop Highest Average Temperature" alarm came in at 0851:58 with a reading of 591.2 degrees Fahrenheit. At 0852:01.492 OPS Control Room personnel received a "Unit 1 Overtemperature Delta T Reactor Trip" concurrent with a "Unit 1 Reactor Trip" and "Turbine Trip Reactor Trip Above P8" alarm.

OPS Control Room personnel implemented procedure EP/1/A/5000/01, Reactor Trip Or Safety Injection. Motor EIIS:MO! driven Auxiliary Feedwater (CA) EIIS:BA! pumps 1A and 1B were manually started due to decreasing levels in the steam generators (SGs) EIIS:SG!. The turbine driven CA

pump automatically started at 0854:46 when the levels in SGs B and C dropped below 12 percent. At 0900:03, a Feedwater Isolation signal was received because of the Reactor trip with T-ave below 553 degrees Fahrenheit. Due to a problem with the status lights EIIS:IL! associated with the signal, (PIR 1-M92-0124), OPS Control Room personnel also manually initiated Feedwater Isolation as a precaution.

During trip recovery activities, FWPT 1B seized. Work order (W/O) 92055186 was generated to investigate the problem. The W/O documented the replacement of a breakdown bushing and the machining of the sleeve which was galled as a result of a temperature differential problem between the upper and lower pump casing, causing the pump to seize.

The maximum Pressurizer pressure experienced during the transient was 2333 psig, therefore, PORV 1NC-34 opened. The SM PORVs for SGs 1A, 1B, and 1D lifted when steam line pressure increased above 1092 psig, and the SM Code Safety valves lifted when steam line pressure increased above 1170 psig. The above mentioned valves operated as designed and seated once pressures decreased below the respective setpoints. The SM PORV for SG 1C was tagged out for

maintenance.

No-load conditions were achieved after approximately 2 hours. SG 1B narrow range level took approximately 2 hours to recover to 39 percent after decreasing to below 5 percent. PZR level took approximately 1.5 hours to recover to 25 percent after increasing to 72 percent. Reactor Coolant (NC) system EIIS:AB! T-ave and SG pressures achieved no-load conditions within 30 minutes following the trip.

Notification to the NRC was made at 1135, on July 26, 1992, as required according to procedure RP/0/A/5700/10, NRC Immediate Notification Requirements.

Subsequent investigation into the loss of vacuum on FWPT 1B condenser revealed that valve 1RC-43, FWPT 1B Outlet Waterbox Isolation, was not fully opened, contrary to the external position indicated on the valve. Based on differential pressure (DP) measurements across valve 1RC-43, the valve was approximately 30 percent open as opposed to being 100 percent open as required. It is felt by OPS personnel that the combination of low flow and increasing lake temperatures caused insufficient steam condensation resulting in a high backpressure and a decrease in vacuum. Valve 1RC-43 was subsequently positioned to the fully open position as determined by DP measurements.

Additional investigation revealed the Load Rejection Controller for the condenser steam dump valves allowed the valves to open, but later than required. However, once the unit tripped, the condenser steam dump valves opened in a timely manner, as required, via the condenser steam dump Reactor Trip Controller. The investigation concluded that the mixing amplifier EIIS:AMP! card which processes the T-avg signal to the condenser steam dumps (NMA C5-436) was improperly calibrated. The gain on this card was subsequently adjusted, as documented on W/O 92055184.

The high bearing vibration problem experienced on FWPT 1A was corrected by the performance of a coupling alignment, as documented on W/O 92055186.

There were miscellaneous instrument problems as noted by OPS Control Room personnel.

1) W/O 92036575 documented the repair of a loose connector EIIS:CON! found on the control voltage cable EIIS:CBL! which caused Intermediate Range Detector EIIS:DET! channel N35 to fail high.

2) W/O 920551.67 documented the repair of a stuck needle on FWPT 1A suction gauge (1CM LP5930) after the gauge failed at 17,000 gpm.

3) W/O 92055152 documented the replacement of the turbine driven CA suction

pressure transmitter EIIS:PT! (1CA LP5050) for the Unit 1 turbine driven CA pump after the gauge was found pegged and the linkage overranged and bent, causing the pressure gauge to fail high.

4) W/O 92055171 documented the recoupling of the limit switch (1CF LL1040) arm to the valve stem on valve 1CF-104, SG 1A Feedwater Inlet Bypass Control, after the valve position indication malfunctioned.

5) W/O 92055160 documented the replacement of a failed switch (1CA PS5020) which had caused an invalid annunciator EIIS:ANN! alarm on motor driven CA pump 1A low suction pressure annunciator.

Unit 1 was subsequently returned to Mode 1 on July 28, 1992, at 0558.

Conclusion

This event has been assigned a cause of Defective Procedure due to a technical deficiency. When FWPT 1B tripped causing the turbine runback, the condenser steam dumps did modulate open, but did so later than they were required to open. Investigation into the problem by Instrument and Electrical (IAE) and Component Engineering personnel discovered the mixing amplifier card, NMA C5-436, which processes the T-ave signal to the condenser steam dumps was improperly calibrated. The gain was adjusted too low. The gain was subsequently increased. A review of past history revealed the gain was adjusted low during the last Preventive Maintenance (PM) calibration performed on October 19, 1991, during the last Unit 1 refueling outage, using procedure IP/0/B/3001/03, Steam Dump Control System Calibration. The Steam Dump Control System calibration procedure did not previously require a specific type of portable power supply test equipment to be used. Component Engineering personnel suspect that there are some types of portable supply test equipment that may contribute to causing the test signal input to be higher than detected or setting up a ground loop. Therefore, a higher output would be seen during testing thereby causing the gain to be adjusted lower. component Engineering personnel determined that various power supply test equipment had been used during previous calibrations. To correct this problem, a procedure change was issued to the Steam Dump Control System Calibration procedure to specify the test equipment to use when performing the calibration. The procedure change also gives more guidance on dynamic acceptance criteria. A review of the Unit 2 calibration data work sheets did not reveal any similar problems. Component Engineering personnel also reviewed all calibration procedures used to calibrate circuitry with the same or similar loop design. The procedures were found to be adequate. Additionally, Component Engineering personnel will check for suspected test equipment problems while performing the steam dump control system calibration during the next refueling outages on Units 1 and 2. If the condenser steam dumps had opened when required during the turbine runback, the Reactor trip would have been prevented.

As a result of the problem experienced with valve 1RC-43, ops personnel have begun a surveillance program to monitor the vacuum on FWPT 1B condenser as compared to FWPT 1A. The monitoring will take place in the Control Room with the observance of the trend recorder. This surveillance will continue until lake temperature decreases. OPS personnel have also made changes in procedures OP/1&2/6250/01, Condensate

And Feedwater, to contact OPS staff for guidance if condenser vacuum pressure changes are observed between FWPTs 1A and 1B. Additionally, the valve stem on 1RC-43 has been marked, since positioning it in the open position, and will be monitored for movement. A review of the work history on the valve to determine what problems have been found in the past and what work has been done on the valve has been completed by System Engineering personnel and will be used to determine the future of valve 1RC-43. This information will also be used to determine why valve 1RC-43 was not in the fully open position. The results of the determination will be referred to the Human Performance Enhancement System (HPES) working group reviewing mispositioned devices. Lastly, a review of similar valves on Units 1 and 2 will be conducted for comparable arrangement and conditions.

A review of the Operating Experience Program Database for 24 months prior to this event revealed four reportable events attributed to Procedure Deficiency resulting in an Engineered Safety Features actuation, however, none of the events resulted in a Reactor trip. This event is not considered to be recurring.

There were no personnel injuries, radiation overexposures, or uncontrolled releases of radioactive material as a result of this event.

CORRECTIVE ACTIONS:

Immediate: 1) Motor driven CA pumps 1A and 1B were manually started by OPS personnel.

Subsequent: 1) IAE personnel adjusted the gain on the mixing amplifier card to correct the problem with the condenser steam dumps.

2) Maintenance personnel performed a coupling alignment on FWPT 1A to correct the vibration problem.

3) Component Engineering personnel revised procedure IP/0/B/3001/03 to indicate the power supply test

equipment to use when performing the calibration on the steam dump control system. The procedure change also gives more guidance on dynamic acceptance criteria.

4) Component Engineering personnel performed a review of the Unit 2 calibration data work sheets and they did not reveal any similar problems.

5) Component Engineering personnel reviewed all calibration procedures used to calibrate circuitry with the same or similar loops and found them to be adequate.

6) OPS personnel have begun a surveillance program to monitor the vacuum on FWPT 1B condenser as compared to FWPT 1A. This will continue until lake temperatures decrease.

7) OPS personnel have made revisions to procedures OP/1&2/6250/01 to contact OPS staff personnel for guidance if condenser vacuum pressure changes are observed between FWPTs 1A and 1B.

8) The valve stem on valve 1RC-43 has been marked, since positioning it in the open position, and is being monitored for movement.

Planned: 1) Component Engineering personnel will check for suspected test equipment problems while performing the steam dump control system calibration during the next refueling outages on Unit 1 and Unit 2.

2) Component Engineering personnel will evaluate the need for changes to valve 1RC-43.

3) System Engineering personnel will conduct a review of similar valves on Unit 1 (A Train) and Unit 2 for comparable arrangement and conditions.

4) System Engineering personnel will investigate why valve 1RC-43 was not in its fully open position.

SAFETY ANALYSIS:

Prior to the unit trip, when FWPT 1B tripped on loss of FWPT condenser vacuum, the turbine commenced a load rejection, as required. The unit tripped on the OTDT trip signal. This Reactor trip input protects the core against DNB and causes the Reactor to trip when 2 out of 4 channels exceed the setpoint. During this transient, channels 1 and 3 exceeded the OTDT setpoint causing the Reactor trip. The condenser steam dumps which modulated open later than required during the turbine runback,

caused an increase in NC system temperature and pressure. Valve 1NC-34 modulated open to limit NC system pressure. The SM PORVs which provide a means to remove heat from the NC system, and the SM code safety valves which prevent overpressurization of the SGs, modulated open when their respective setpoints were exceeded. OPS Control Room personnel manually started the motor driven CA pumps when they observed the levels decreasing in the SGs, not waiting for the automatic actuation. In the

event the NC system pressure had continued to increase after the Reactor trip, the Pressurizer code safety valves are required to open to limit NC system pressure to a value less than the design pressure to ensure NC system integrity is not breached.

It should be noted that the plant is designed for a safe shutdown without the use of the condenser steam dumps, and if the condenser steam dump valves had operated properly, the unit trip would not have occurred.

During this transient, the systems involved responded as required, and the operator action was as expected, after the condenser steam dumps did not open in a timely manner.

The health and safety of the public were not affected by this event.

ADDITIONAL INFORMATION:

Sequence of Events:

PR - Personnel Recollection
OAC - Operator Aid Computer
ER - Events Recorder
PTR - Post Trip Review Report
SRO - Senior Reactor Operator Logbook
RO - Reactor Operator Logbook

Date Time Event

7/24/92 Approx. 1711 OPS personnel swapped FWPT 1B to the lead. (PR, SRO)

Approx. 1711 OPS Control Room personnel received alarm due to drop in FWPT 1B condenser vacuum. (PR)

7/26/92 0850:53 "Hi CF Pump Turbine Condenser B Vacuum" alarm received in Control Room. (OAC) (-23.94 inches

mercury). "Trend Groups variable Limit
Exceeded" alarm received in Control Room. (OAC)

0851:18 "Hi CF Pump Turbine Condenser B Vacuum " alarm
received in Control

Room. (OAC) (-22.67 inches of mercury).

0851:33 "Hi CF Pump Turbine Condenser B Vacuum" alarm
received in Control Room. (OAC) (-21.27 inches
of mercury).

0851:35.201 FWPT 1B tripped. (ER,SRO)

0851:35.331 "Condensate System In Full Load Rejection mode"
alarm received in Control Room. (OAC) OPS
Control Room personnel implemented procedure
AP/1/A/5500/03, Load Rejection Case II. (PTR,
PR, SRO)

0851:57 Condenser steam dump valves in control bank 1
start to modulate open. (OAC)

0851:58 Pressurizer PORV 1NC-34 open. (OAC) "Hi NC Loop
Highest Average Temperature" alarm received in
Control Room. (OAC) (Temperature is 591.2
degrees Fahrenheit).

0852:01.492 "Unit 1 Overtemperature Delta T Reactor Trip"
alarm received in Control Room. (ER,SRO)

0852:01.589 "Unit 1 Reactor Trip Switchgear A". (ER)

0852:01.607 "Unit 1 Reactor Trip Switchgear B". (ER)

0852:01.938 "Turbine Trip Reactor Trip Above P8" alarm
received in Control Room. (ER)

Approx. 0852 OPS Control Room personnel implemented procedure
EP/1/A/5000/01, Reactor Trip Or Safety
Injection. (SRO, PTR)

0852:03 Pressurizer PORV 1NC-34 closed. (OAC)

0852:12 SM PORV B open. (OAC)

0852:13 SM PORV A open. (OAC)

0852:20 SM PORV D open. (OAC)

0853:02 Motor driven CA pumps 1A and 1B manually started by OPS Control Room

personnel. (PR, PTR, OAC, SRO)

0853:49 SM PORV D closed. (OAC)
SM PORV B closed. (OAC)
SM PORV A closed. (OAC)

0854:46 Turbine driven CA pump automatically started. (OAC, PTR)

0900:03 Feedwater Isolation signal received. (PR, PTR, SRO)

approx. OPS Control Room personnel manually initiate
0905 Feedwater Isolation. (SRO)

approx. Several W/Os generated to work on instrument and
1030 component problems (SRO)

1135 NRC notification made by OPS Shift Supervisor. (PR)

7/28/92 0558 Unit 1 entered Mode 1. (RO)

Duke Power Company T. C. McMEEKIN
McGuire Nuclear Generation Department Vice President
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DUKE POWER

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station Unit 1
Docket No. 50-369
Licensee Event Report 369/92-08

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 369/92-08 concerning a Unit 1 Reactor Trip. This report is being submitted in accordance with 10 CFR 50.73 (a) (2) (iv). This event is considered to be of no significance with respect
o the health and
safety of the public.

Very truly yours,

T. C. McMeekin

TLP/bcb

Attachment

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